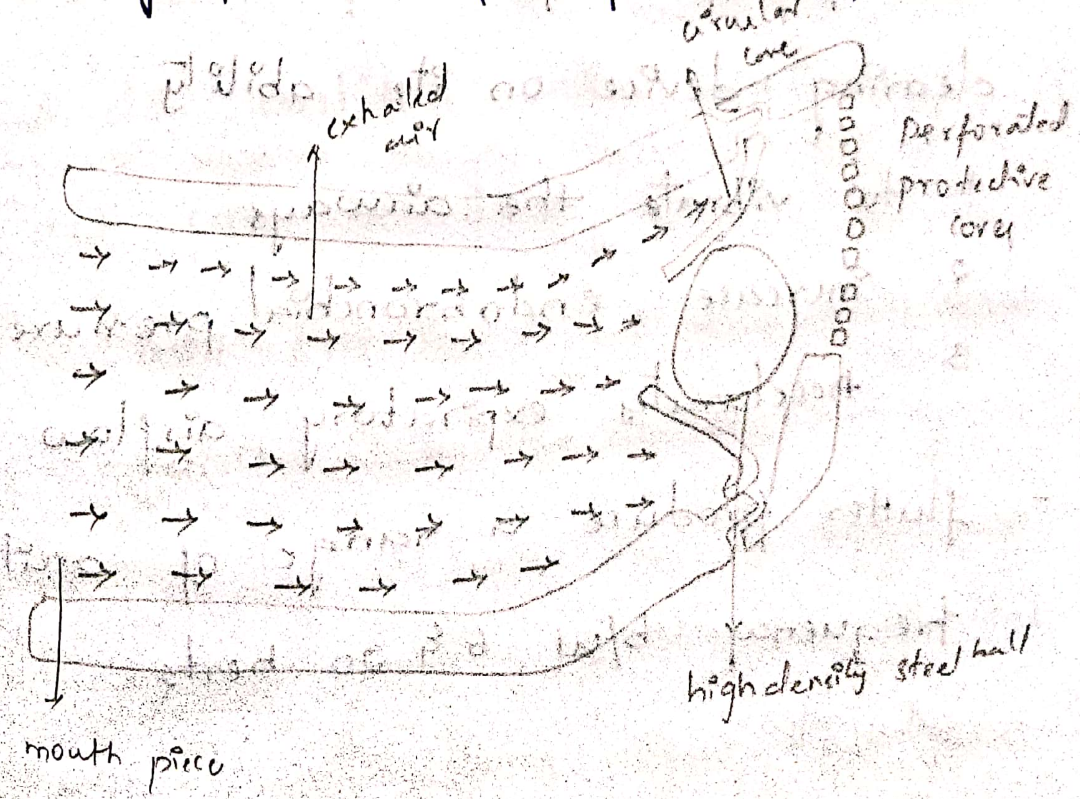
FLUTTER

Introduction

- flutter is a small portable device
- it is shaped like a pipe with a hardened plastic mouth piece at one end & a plastic protective perforated cover at the other end & a high density stainless steel ball resting in a plastic circular cone inside
- As the steel ball rolls & bounces up & down it results in production of oscillations in expiratory pressure & airflow is produced.



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Indications

- flutter provides positive expiratory pressure therapy for patients & mucus producing respiratory conditions.

- bronchiectasis, bronchitis, cystic fibrosis, atelectasis, COPD & other conditions.

frequency & duration of use

- 5 to 15 min generally morning or late afternoon / eveing sessions are recommended.

principles of operation

- the principles of flutter as mucious clearing device on its ability
  1. to vibrate the airways
  2. increase endobronchial pressure
  3. Accelarates expiratory airflow

- flutter produce a range of oscillations frequency b/w 6 & 20 hertz

direction for use

- the patient should be seated with back support & straight & head slightly lifted upward so that the upper airway is wide open.
- elbow resting on a table
- this will allow exhaled air flow smoothy from the lungs & out to the flutter
- the angle at which the patient hold the flutter is difficult.
- the device is held horizontally & tilted slightly either downwards or upwards until a max oscillatory effect can be felt
- this will ensures that the ball not only bounces but also rolls during exhalation
- this combined rolling & bouncing of steel ball produce vibrations that dislodges mucus from the airways.

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phase 1

- Mucus loosening & mucus mobilization:

instruct the patient to slowly inhale to approximately 3/4th of his full breath.

↓

place the flutter in the mouth

↓

position the flutter at proper angle & perform 2-3 sec breath hold

↓

this allows the inhaled air to be evenly distributed throughout the lungs

↓

Now the patient should exhale through the flutte

↓

during exhalation keep the cheeks stuff so that the vibrations produced by flutter are not wasted in the cheeks

↓

have the patient concentrate on vibrations of airways & continue to exhale then

the flutter

↓

ask the patient to repeat this technique for 5-10 breaths to loose & mobilise the mucus

↓

the mucus moves further up the airways with each flutter exhalation.

phase 2

- Mucus elimination.

ask the patient to breath in slowly & as fully

↓

fill the lungs with air, again perform 2-3 sec breath hold

↓

Now the patient exhale forcefully through flutter as completely & as comfortably as possible.

↓

this forceful exhalation moves mucus upto a level in the lungs that

triggers the cough

↓

if the mucus is not easily coughed out for 1or 2 elimination breath ask the patient to attend huff maneuver

↓

the series of 5-10mucus loosening breath with cough suppresion followed by 1or 2 mucus ~~Suppression followed by 1 or 2 mucus~~ elimination breath with cough ~~shot~~ and result in succesful airway clearance.

cleaning the flutter

- flutter is recommended for single patient use only

↓

instruct the patient to clean the flutter after each session to remove the moisture & mucus

contraindications

- pneumothorax
- rt sided heart failure

→ cough

- it is defined as forced expiration with closed glottis
- it is the protective mechanism of respiratory tract due to stimulus
- it is often worse at night or on walking & may set of changes in temp & humidity or by exposure to irritants such as or

types of cough

1. freely productive seen in the case of bronchiectasis
2. paroxysmal cough seen in the case of chronic bronchitis ; asthma.
3. painful cough seen in the case of pneumonia with pleurisy
4. Accompanied by stridor (high pitched sound) seen in case of whooping cough, partial laryngeal / brachial obstruction
5. recurrent coughing after eating & drinking seen in the case of aspiration
6. chronic productive cough seen in

the case of bronchitis, bronchiectasis

7. persistent dry cough seen in the case of intersitial lung disease

8. nocturnal cough seen in the case of asthma in childrens & young adults

<u>cough reflex</u>

- it is a protective reflex which aids the airway of depressions & foreign bodies

- it is a protective reflex that occur the because of irritation of respiratory tract & some other areas such as external auditory canals

- causes - • irritating agents
  • cardiac diseases
  • congestive heart failure
  • pulmonary diseases
  • COPD
  • tumor in thorax which may exert pressure on layrnx trachea bronchii & lungs

Mechanism

- cough begins with deep inspiratⁿ then forced expiratⁿ with closed glottis
- this increases intrapleural pressure above 100mm of Hg (intrapleural means intra thoracic & intraabdomen)
- then glottis open suddenly with explosive outflow of air (high level)
- the velocity of airflow may reach 960km per hour

causes :- explosion of irritants outside the respiratory tract

phases of cough reflex

1. inhalatⁿ
2. forced exhalatⁿ
3. release of air

flow chart

inhalatⁿ

↓

forced exhalatⁿ against closed glottis

↓

air violently release of air from lungs following of glottis

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accompanied by a distinct sound.

- cough can be voluntary & involuntary

types of cough

→ double cough - deep inspiration

- patient performs two coughs in one breath

- the second is usualey more forcefully than first one

→ controlled cough

- three breathe exhale normaley after first two breath & then coughing firmly on the third breath

→ Series of cough

- patient takes a small breath & gives a pair cough then bigger breath & gives a harder cough & finally deep breath & forcefully cough

→ houghing -

patient takes a deep inspiration & air is forcefully exhaled as in coughing except that mouth is kept open

chest physio techniques

these physio techniques useful for mobilizating & to clearence of secretions

- postural drainage
- percussions
- vibration
- shaking
- breathing exs
- ACBT
- Autogenic drainage
- suctioning
- cuffing techniques
- Manual hyper inflation
- relaxation positions
- flutter

① . chest percussions -

Also called clapping. it is performed with the aim of loosening retaining the secretions from the airways so they may be remore by suctioning (or) cuffing

- the rhythmical force is provided by the clapping the care given with cupped hands

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against the thorax over the affected lung segments

- it is performed during both in inspiratory & expiratory phases of breathing

- the mechanism underlined the percussion is transmission of wave of energy through the chest wall into the lungs the resulting movement loosens the secretions from bronchial walls & more then proximally so that it can be removed through coughing.

- percussion is used along with postural drainage position & with active cycle of breathing techniques to increase its affectiveness

__equipment require for percussion__ :-

the only equipment required for manual percussion is the care givers cupped hands to deliver the force to mobilize the secretions.

- for adults & older paediatric population electric or numatic percussors that mechanically stimulate the percussion are used.

- to infant bell of stethoscope, padded rubber nipple, pediatric anaesthia mask can be used.

preparation for percussion -

1. place the pt in appropriate postural drainage position

2. place thin towel (or) hospital gown over the pt's skin where the percussion is applied.

3. adjust the bed so that proper body mechanics may be used during the Rx

4. fatigue or injury of care givers may be the result of lengthy or rigorous if proper body mechanics is ignored.

treatment with percussions

- positioned the hand in a cup with finger & thumb adducted it is imp to maintain cupped position of the hand throughout the treatment
- the sound of percussion should be hollow sound.
- the rate of manual percussion is normally 100 - 180 / min
- the force applied to the chest wall to be equal
- percussions doesn't occur over bony prominence scapula, clavicle & over the floating ribs should be avoided
- percussions should be avoided over breast tissue
- contraindication
- osteoporosis
- TB
- carcinoma
- open wounds
- ribs #

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② Vibrations

involves gentle high frequency performed with the aim of moving the secretions from the lungs peripheral to central airways where they may be suctioned or caughed out or experated.

it is performed by co-contracting the muscles of upper extremity to cause vibrations by applying pressure to the chest wall with the hands.

- they are performed only during the expiratory phase starting with the inspiration (central cor mid point) continuing until the end of expiration.

equipments

- Manual hands
- Mechanical vibrations are available to administer the Rx

preparation for vibration

- place the pt in a appropriate postural

drainage position

- place a thin towel (or) hospital gown over the pt's skin

- proper body positioning of the therapist is imp to deliver an affective Rx

treatment with vibration

1. the hand may be placed side by side/on top of one another

2. the pt is instructed to take a deep breath in a proper postural drainage position

3. co-contraction of U.E is performed to vibrate the chest wall beginning at the peak of inspiration to the end of expiration.

4. if the pt is on ventilator, vibration is given with the ventilator controlled exhalation

5. the frequency of vibration is b/w 12 - 20 Hz

advantages -

- these vibrations are helpful to mobilize the secretions

- they are better tolerated by the patient post surgery

(3). Shaking

- those are performed with the aim of moving secretions from the lung periphery to larger / central airway where they may be suctioned / expectorated

- they are more vigorous in nature. it is a stranger bouncing force which give a concurrent compressive force to the chest wall

- these are performed at the peak of inspiration until the end of expiration

- the frequency of shaking 2 Hz

equipment - manual handle

preparation for shaking

- place the pt in a proper postural drainage position

- place a thin towel / hospital gown over the pt skin

- proper body position of therapist is imp. to deliver an affective Rx

treatment

- for shaking with the pt in proper postural drainage position. place your hands over the lung to be beated and instruct the pt to take in a deep breath

- at the peak of inspiration apply slow rhythmic bouncing pressure to the chest wall until the end of expiration

advantage

- to mobilise the secretion

- well tolerated by post surgical position

4. postural drainage

def - it consist of positioning the pt to allow gravity to assist in the drainage of secretion from specific areas of the lung

- the length of time spent in each position & the total R_x time depends on the quantity of secretion in each area & the no of areas that have to be drained.
- the avg time is 15 - 20 min
- the worst areas should be drained first.
- a radiograph is useful in isolating the affected areas
- postural drainage should never be carried out immediately before/after meal because the pt will be either too tired to enjoy his meal / the pt may vomit.

postural drainage can also only be carried out effectively if the pt takes an active part in his Rx

anatomy of

bronchial segments

bronchial tree

equipment required

- air beds are most often used in ICU's
- manual / electric beds are used to position the pt
- use of pillows / bed rolls to support the body parts to relieve from pressure sores
- for home Rx use of pillows / a slant board, sofa cushions or bean bag chair is used.

preparation

- Nebulized bronchodilators before postural drainage may facilitate the mobilization of sputum

- an adequate intake of fluid ↓ses the viscosity of secretion allowing easy mobilization.
- in the ICU to be familiar with the multiple lines, leads, tubes attached to the pt
- position the pt with little stress to both staff & pt
- have suctioning equipment ready to remove the secretions from an artificial airway / the pt's oral / nasal cavity after the Rx

treatment

- after determining the lobe of the lung to be treated, position the pt in appropriate position using pillows / bedrolls
- if postural drainage is used in conjugation with other techniques, the time in each position may be ↓sed eg: if percussion / vibration are performed while the pt is in postural drainage

3-5 mins is sufficient.

- a pt who requires closed monitoring should not be left unattended in a trendelenburg position (head down position)

- the pt should be encouraged to take deep breath & cough after the Rx & if possible after each position.

- secretion may not be mobilized immediately after the Rx sometimes 30mins - 1 hr may be required.

- the pt may be informed & requested to clear the secretion.

<u>positions for postural drainage</u>

<u>upper lobe</u> -

1. for apical segment

- the pt should sit upright with slight variation according to position of lesion which may necessitate leaning slightly backwards forwarded / side ways

- the position is usually for infants /pts being nursed in a recumbent position but occasionally may be required if there is an abscess or stenosis of a bronchus in the apical region

2. posterior segment

(a) right

- patient should lie on his left side & then turn 45° on to his face resting against a pillow with another supporting his head he should place his left arm comfortably behind his back with the right arm resting on the supporting arm right knee should be flexed

(b) left

patient should lie on right side & then turn 45° on to his face with three pillows arranged to raise the shoulders 30cm from the bed he should place his

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right arm behind the back with his left arm resting on supporting pillows both the knees should be slightly flexed.

(c) anterior

pt should lie flat on his back with arms relaxed to his side, knees should be slightly flexed over a pillow

Middle lobe

1. lateral segment - medial segment

- pt should lie on his back with his body quater turned to left maintained by a pillow under right side from shoulder to hip & arms relaxed by his side
- foot of the bed should be raised 35 cms (14 inches) from the ground the chest is tilted to an angle of 15°

2

2. Superior - inferior segment

pt should lie on his back with his body quarter 3rd turned to right maintained by a pillow under left side from shoulder to hips & arms relaxed by his side

- foot of the bed should be raised 35cm (14 inches) from the ground chest is tilted to an angle of 15°

lower lobe

1. apical segment

pt should lie prone with head turned to one side, arms relaxed in a comfortable position by side of head & there pillow under the hip

2. Anterior basal segment

pt should lie flat on his back with buttocks resting on the pillow & knees bend foot of the bed should be raised 46 cms 18 inches from the ground chest is tilted to an angle of 20°

3. posterior basal segments

- pt should lie prone with head turned to one side, arms by the side of head & pillow under the hips

- foot of the bed should be raised 46 cm (18 inches) from the ground chest is tilted to angle of 20°

4. medial basal segment

pt should lie on right side with a pillow under hips & foot of the bed should be raised 46cms, 20° chest tilted

5. lateral basal segment

pt should lie on opp side with a pillow under hip & foot of the bed should be raised 46cm, chest tilted to 20°

contraindications of postural drainage

- head injuries (including CVA because ICP would be increased)
- severe HTN (as the venous return is ↑sed with tipping & this can overload the heart)
- following oesophagectomy there can be unclued press on the anastomosis & tipping may cause regurgitation
- severe hemoptysis when all forms of physiotherapy should be discontinued until there has been discussion with the doctors
- aortic aneurysms which could be under tension if the pt is tipped

- pulmonary edema which corrects in the dependent area, postural drainage would cause extreme dyspnea & probably worsen the situtation

- Surgical emphysema which might track towards the face if the pt is tipped & might result in dyspnea

- tension pneumothorax without an intercostal drain this condition should not require physiotherapy but must never be tipped as the cardiac embrassment may lead to cardiac arrest.

- cardiac arrhthymias which can be worsen by postural drainage in some position the myocardial oxygen demands would be greater & its sensitivity to abnormal ~~rhyt~~ arrhythmias is rised

- hiatus hernias should not be tipped as the pt may regurgitate gastric juices.

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- the filling cycle of peritoneal dialysis. the decent of the diaphragm is impeded during this phase & tipping may cause more respiratory disstress
- facial edema from burns will be increased with tipping
- eye operation where there may be some associated edema which could be increased with tipping.

→ physiotherapy management for COPD

- problem list

1. ↑sed secretions which are difficult to remove
2. breathlessness
3. ↓sed thoracic mobility.
4. ↓sed exercise tolerance
5. pain.

Aims

1. to facilitate removal of secretion.
2. to relieve from dyspnea
3. for ↑sng ventilation.
4. to improve breathing pattern & breathing control.
5. to mobilize thorax & shoulder girdle
6. to correct posture
7. to improve exercise tolerance.
8. to help the patient rehabilitate to as full & independent life as possible by over all team approach
9. increase respiratory muscle strength.

Means :

1. for removal of secretion — ACBT, PD, chest PT, BE.
2. dyspnoea - relaxation exs are given
3. for improving breathing pattern - teach breathing control for clearing secretions, breathing control during walking or while doing functional activities
4. Mobilising thorax - thoracic mobility exs are performed. thoracic expansion exs are also done
5. postural correction is done by postural awareness. using pillows & positioning & changing the postion for every 2 hrs
6. exs tolerance is treated by advising O_2 therapy or IPPB, participation in group ex program. regular ex, endurance training.

7. Rehab is done by doing strengthening exs, stretchings & active m/s for respiratory muscle training. incentive spirometry is used.

Rx techniques:

- All the Rx tech are same for COPD condition like ACBT, PD, chest pt, BE, relaxation tech. these should be written in detail with specific diagram.
- In case of surgical procedures pulmonary rehab is done.
- if the condition continues it results in emphysema.
- suctioning & manual hyper inflation for clearance of secretion
- for mobilisation of secretion flutter can be used (ambubag is used)

Aims

1. for mobilising secretion
2. for clearance secretion
3. for ↑sng ventilation
4. to relieve from breathlessness
5. to ↑ BC & breathing pattern.
6. to relieve from bronchospasm
7. to ↑se thoracic mobility
8. to relieve from anxiety & depression.

Humidifier

- it is a device which delivers the max amount of water vapour ~~out~~ without producing particular water

(or)

humidification is a method to artificially condition the gas used in respiration of a patient as a therapeutic modality.

→ **Indication**

- to humidify by medical gases (mostly O_2)
- to manage hypothermia
- to treat bronchospasm caused by cold air.

→ **principles**

- temp
- Surface area
- time of content
- thermal mass

1. temp - as the temp of gas ↑ses, its ability to hold water vapour ↑ses

2. surface area - there is more opportunity

for evaporation to occur ↑ with greater surface are of contact b/w water & gas.

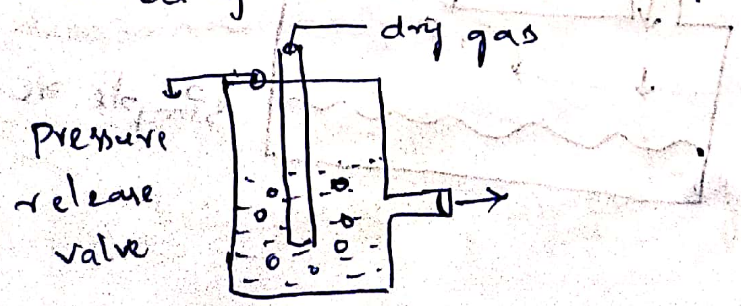
3- <u>time of contact</u> - there is more greater opportunity for evaporatn to occur the longer a gas remains in contact with water

4- <u>thermal mass</u> - the higher the mass of water or core element of humidifier the higher its capacity to transfer or hold heat.

<u>types</u>

1. bubbled through humidifier
2. pass over humidifier.

1. - gas passes through tube to bottom of water reservoir
   gas bubbles thus reservoir provides humidity for O_2 therapy.



2 - pass over humidifer

working - blow gas over heated sterile water gas absorbs the water, vapour is inhaled by the patient.

3 types - ① simple reservoir

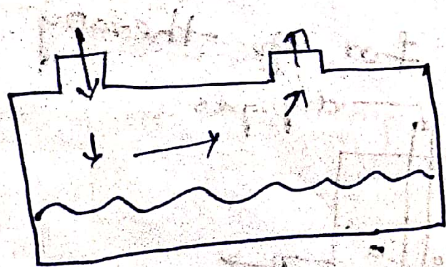
② wick

③ membrane.

1 - working - blow gas over the surface of heated water, used in mechanical ventilation

- total surface area of contact b/w gas & water is very less

- humidifies is placed below the patient's airway level to prevent one flow of the airway by condense or water real the taps of water to prevent contaminat°

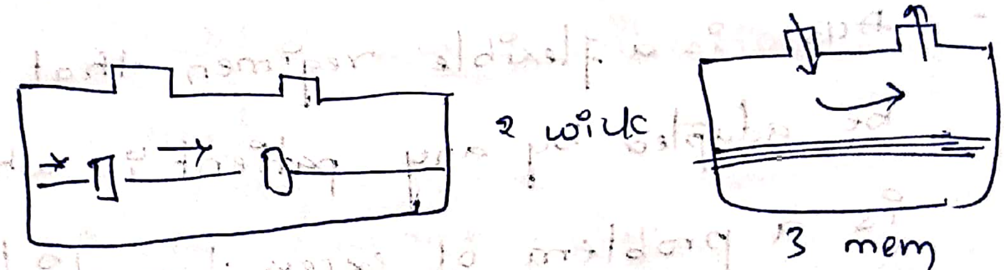


simple reservior.

2- it contains an absorbent material which ↑ses the total surface area of dry gas to interface with heated water

working - dry gas moves in the chamber & flows around the wick & absorbs heat & moisture.

gas saturated with water vapour leaves the chamber



3 — <u>membrane humidifier</u>

- it uses hydrophobic mem which only allows passage of water vapour, precluding liquid water to travel through it

<u>advantages of pass over</u>

- it can maintain saturatn at high flow rates
- minimal risk for spreading infection

ACBT (active cycle of breathing)

Introduction

- for this technique active participation of patient is most imp
- ACBT has been shown to be effective in clearance of bronchial secretions & to improve lung function without increasing hypoxaemia or airflow obstruction.
- ACBT is a flexible regimen that can be adapted by any patient in whom there is a problem of excess bronchial secretions & can be used with or without assistance
- this method encourages active participation of patient & has been shown to be effective when performed by the patient alone or with the aid of assistance.
- postural drainage positions may also be used along with ACBT.
- it consist of three phases.

1. breathing control
2. thoracic expansion
3. forced expiratory technique

equipment required for ACBT

- the only equipment required for this technique is the patient's or therapist hand to percuss, vibrate or shake the chest wall during thoracic expansion phase
- mechanical percussers or vibrations may also be used
- if postural drainage positions are used equipment for positively positioning the patient will be required.

preparation for ACBT

- Rx of 2 or 3 productive areas during one session may be tolerated by most patients.
- the patient is positioned in a postural drainage position to stimulate drainage of productive area of lung.

- A min of 10 min in any productive position may be necessary to clear a patient with moderate amount of secretions.

- patient after surgery or with minimum secretions may not require much time

<u>phases of ACBT</u>

1. <u>breathing control</u> - it is the resting period b/w the more active parts of the cycle

- it is the tidal breathing at the patient's own rate & depth

- the patient is encouraged to relax the upper chest & shoulder & the lower chest is abdomen should be active

- the phase of breathing control should last as long as the patient require to relax & to prepare for next phases

- time is usually 5-10 secs.

2. <u>thoracic expansion exs</u> - the emphasis during this phase is on inspiration

- the patient is instructed to take in a deep breath to inspiratory reserve
- expiratn is passive & relaxed.
- the therapist or patient may place a hand over the area of thorax being treated which further encourages ↑sed chest wall movement.
- chest percussions, shaking or vibration may be performed in combo with thoracic expansion as the patient exhales.
- for surgical patients or those with lung collapse, the breath hold at end of inspiratn encourages collateral vent to assist with the expansion of lung. 3 sec breath hold.

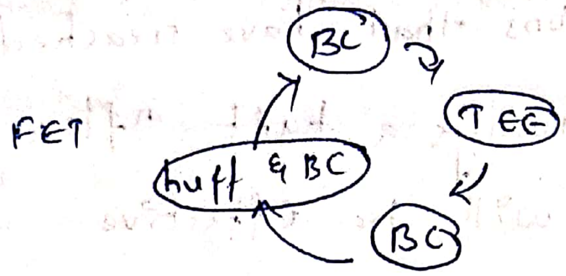
3. <u>forced expiratory technique</u>

- this phase consist of coughing, huffing along with breathing control
- it is a combination of one or two (huff)

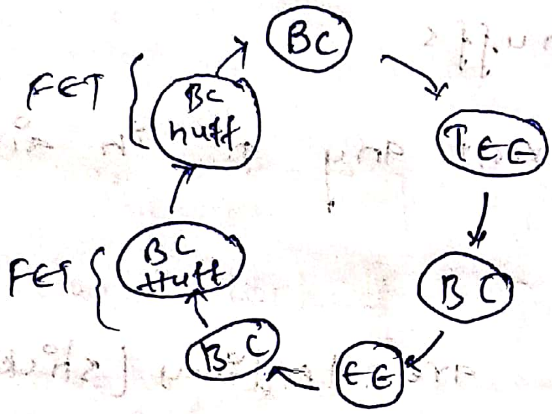
forced expirations a period of breathing control

- A huff is a rapid force exhalam with open glottis
- this maneuver can be compared with fogging a pair of eye glasses; with warm breath so that they are cleaned.
- in an effective cough the muscles of abdomen contract to provide greater expiratory force.
- unlike a cough in which glottis is closed a huff requires glottis to remain open
- two different levels of huffing are expiratory characterized by forced expiratory technique
- to mobilise secretions from peripheral areas a huff after a medium sized breath will be effective
- this huff will be longer & quieter.

- to clear secretions that have reached the proximal airways a huff after a deep breath in will be effective
- this huff will be shorter & louder
- the patient must (~~perform exp b~~ c) pause for breathing control after 1 or 2 huffs
- this will prevent any ↑se in airflow obstruction
- if secretions are tenacious (sticking, thick) two cycles of thoracic expansion may be necessary to loosen secretions before the forced expiratory technique.
- In a patient with bronchospasm be may be along as 20sec
- when huff from medium sized insp to complete exp is non productive & dry sounding the treatment may be concluded.



when secretions are tenacious



Advantages of ACBT

- ACBT along with p.d & percurssion allows the patient to participate actively in mobilisation of secretions.
- this technique may be adapted for patients with bronchospasm, acute stage of pulmonary disease.
- Use in O₂ saturation caused by chest percussion may be avoided by using ACBT technique.

for children this technique may be introduced at the age of 30 years so that they become independent for the technique at age of 8-10 years.

<u>disadvantages</u>

- for young children & extremely ill patients care giver will be necessary to assist the patient with this technique.
- An assistance will also be required for the patients in whom percussion of shaking are done during Te phase

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Oxygen therapy

- O_2 therapy refers to supplemental O_2 given to people who largerly requires O_2 due to breathing disorder (or) aren't able to get enough O_2 naturally
- symptoms of low O_2 includes rapid breathing, coughing or wheezing & changes in the colour of skin

→ **Indications**

- COPD
- pneumonia
- severe asthma attack
- later stage heart failure
- cystic fibrosis
- sleep apnea
- hypoxia
- pre & post cardiac or respiratory arrest
- respiratory failure
- dysponea
- post op

- hypoxemia
- shock
- metabolic acidosis
- during surgeries

→ O_2 flow rates

- determines amount of O_2 delivered to patient
- measured in liters/min
- rate varies according to patient condition & route of O_2 administration.

→ to regulate O_2% concentratn we need :

- ABG analysis
- O_2 analysis
- pulse oximeter

→ O_2 delivery systems

- depends on patients O_2 need, comfort & developmental considerations.
- nasal cannula
- nasal catheter
- trans tracheal culture
- simple mask

- partial re-breather mask
- non-rebreather mask
- venturi mask
- O_2 tent

* <u>Nasal cannula</u>

- common inexpensive device
- easy to apply
- doesnot interfere with eating/talking
- relatively comfortable
- permits some freedom of movements
- well tolerated by clients
- delivers low concentratn of O_2 (21-45%) at a flow rate of 2-6l/min.

* <u>Nasal catheter</u>

- infrequently used as it is uncomfortable
- may cause trauma
- inserted through nostril & the end of catheter resting in oesophagus
- should be changed to another nostril every 8 hrs

- gastric - distention often occurs.

* face mask

- O_2 mask is filled carefully to avoid leakage of O_2

- should not be too tight

types - 1. simple 2. partial rebreather
3. non-rebreather 4. Venturi - mask.

1. simple

- has vents on sides for air to leak in & there by diluting source O_2.

- allows exhaled CO_2 to escape.

- used when ↑sed O_2 is needed for short period (less than 12 hrs)

- delivers O_2 conc from 40-60% at a flow rate of 5-8 l/min

- never apply a simple mask with a flow rate less than 5l/min due to risk of retaining CO_2

* 2. partial rebreather mask

- delivers O_2 concentratn at 60-90% with a flow rate of 6-10 l/min
- O_2 reservoir bag attached allows client to rebreath about 1/3rd the exhaled air
- ↑ses FiO_2 by recycling expired O_2.

3. non- rebreather mask

- delivers highest O_2 concentratn (95-100%) at a flow rate of 10-15 l/min
- one way valves on the mask prevent the room air & clients exhaled air entering the bag so only O_2 in the bag in inspired.

4. venturi mask

- delivers O_2 concentration (24-40-50%) at a flow rate of 4-10 l/min
- colour of device reflects delivered O_2 conc

24% - blue ; 28% - white ; 31% - Orange
35% - Yellow ; 40% - red ; 60% - green.

* face tent

- designed for patients who cannot wear a mask or nasal prongs
- eg: facial surgery or trauma
- provide varying concentratn of O_2 (30-50%) at a flow rate of 4-8 l/min

* trans tracheal O_2 delivery

- it is superior method of delivering O_2 directly into lungs by a small flexible catheter which passes from lower neck trachea
- in this patient requires less O_2 (0.5-2l/min) as it directly enters the lungs.

* O_2 hood

- a rigid plastic dome that encloses an infants head
- provides precise O_2 & high humidity
- gas should not be allowed to blow

directly in to infants face

- hood should not rub against infants neck chain or shoulder
- O_2 flow 15 l/min & 30 % of O_2

Autogenic drainage

it is a self drainage technique

it was introduced by charallier in 1967 for Rx of asthamatic patients

- it is a breathing technique uses expiratory airflow to mobilise the secretions

- it is a self drainage method performs independently by the patient in a sitting position.

- autogenic drainage consists of three phases :

1. unsticking phases - it loosens secretions in the peripheral airways

2. collecting phase - which moves the secretions to the larger central airways

3. evacuating phase - which results in removal of secretions.

- this technique of airway clearance requires much patience & concentration & it is not suitable for children.

→ equipment required for AD :

- no equipment is required to perform this technique

- the patient must posses good proprioceptive stimulus, tactile & auditory perception of mucus moving.

→ preparation for AD

- the patient should be seated in a chair with back support, surroundings should be devoid of distractions allowing patient to concentrate on the breathing technique

- the upper airways (nose & throat) should be cleared of secretions by huffing or blowing the nose.

- the care giver should be seated to the side & slightly behind the patient

- one hand should be placed to feel the work of abdominal muscles & other hand placed on the upper chest.

treatment with AD

- in all the phase, inhalation should be done slowly through the nose if possible using the diaphragm or lower chest.

- A 2-3sec breath hold should follow allowing collateral ventilation to get air behind the secretions.

- exhalation should occur through the mouth with glottis open causing the secretions to be heard (huff)

- vibrations of the mucus may also be felt by the hand placed on upper chest.

* unsticking phase - this phase mobilises the mucus from the periphery of the lungs by lowering the mid tidal volume below the (FRC - functional residual capacity)

- inspiration is followed by deep expiratory into the expiratory ~~restere~~ reserve volume

- this low lung volume breathing continues until the mucus is loosened & starts to move into the large airways.

* collecting phase - this phase collects the mucus in the middle airways by ising the lung volume over the unsticking phase.

- here tidal volume breathing is then changed gradually from ERV towards the IRV - so that the lungs are expanded more with each inspiration.

- this low - midlung volume breathing continues until the sound of mucus decreases signalling its movt into the peripheral airways to be evacuated.

* evacuating phase - in this phase the patient (s) inspiration into the IRV this middle to high lung vol. breathing continues until the secretion are in the trachea & are ready to be expectorated

- the collected mucus can be evacuated by a stronger expiration or a high volume huff

- non-productive coughing should be avoided since it may result in collapse of airways

- the duration of each phase of AD depends on location of secretions & amount of viscosity of secretions & the average Rx time will be 30 - 45 min

- AD is not the Rx of choice for a patient who is unmotivated or unco-operative

advantage:

- since it dounot require any P.D positions it is appropriate for patients with gastrooesphageal reflux & also in patients with airway hyperactivity.

disadvantage

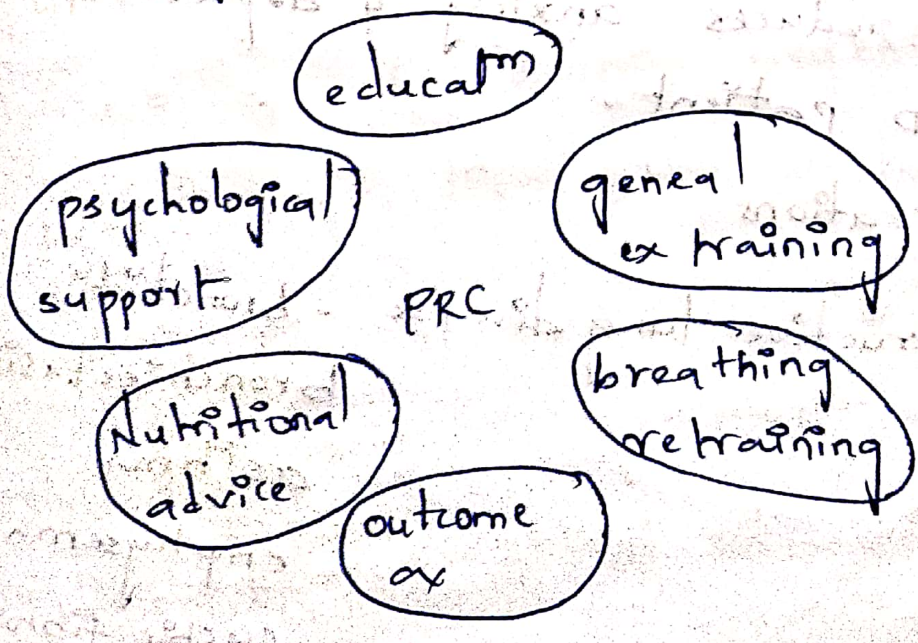
- not given to children.

Pulmonary rehabilitation

→ definition

Act of medical practice where individually tailored multidisciplirary program is formulated with through accurate diagnosis therapy, emotional support & education which stabilises or reserve both physical & psychopathology of pulmonary disease in attempts to return the patient to highest possible functional capacity allowed by pulmonary handicap & overall life situation.

→ pulmonary rehab components



→ goals of pulmonary rehabilitation

1. Aims to reduce symptoms of pulmonary disease
2. decrease disability
3. increase or improve overall quality of life
4. increase participation in physical & social activities.

→ benefits of PR

1. improve ex capacity
2. reduce perceived intensity of dyspnoea
3. it improves quality of life
4. reduces hospitalization
5. reduces anxiety & depression in COPD patient.

→ Indications

1. obstructive lung disease - bronchitis, bronchiectasis, asthma, emphysema, cystic fibrosis

2. restrictive lung disorders
3. Neuromuscular & other disease
COPD patients at all stages of disease appear to benefit from ex training program improving with respect to both ex tolerance & symptoms of dyspnoea & fatigue.

contraindications

1. patients with severe orthopedic or neurological disorder limiting their mobility
2. severe pulmonary artery HTN
3. ex induced syncope
4. unstable angina or MI
5. inability to learn; psychiatric instability & disruptive behaviour.

→ team members of PR

1. Pulmonologist
2. cardiologist
3. psychologist

4. physiotherapist
5. Nurse
6. Social worker
7. family members.

→ **setting for PR**

1. out patient
2. in patient
3. Home.
4. community based.

→ educatⁿ

- educating the patient regarding avoidance of resistants, smoking cessation, proper use of medications, benefits of ex training & maintaining physical activities, bronchial (asthma) hygiene tech & breathing strategies

→ exs training

* components of exs training

  - L.L exs
  - arm exs
  - ventilatory muscles training

* type of exs
  - endurance (or) aerobic exs
  - strength (or) resistance exs
* L.E exercises
  - walking
  - threadmil walking
  - stationary bicycle
  - stair climbing
  - sit & stand.
* arm exs training
  - arm cycle ergometer
  - unsupported arm lifts
  - lifting weights

- strength or resistance - these exs are done by ↑sng the intensity or work load it is in the form of short duration with more intensity/ more work load.

- ventilatory muscle training
* inspiratory muscle training
    - deep breathing exs
    - incentive spirometer
    - inspiratory muscle trainer with the help of threshold device

→ breathing retraining

1. BE - pursed lip breathing
2. PD technique
3. bronchial hygiene tech
    - PD
    - FET
    - AD
    - ACBT
    - flutter
    - percussions, vibrations etc.

→ FITT principle protocol -
total duration - 6 weeks program
frequency - a min of 20 sessions should be given atleast 3 times a week, each session last for 30 min, morning or

afternoon session, both UL, LL training should be done

- high intensity ex greater than 60% of max work rate produces greater physiological benefit & should be encouraged.

→ FITT principle -

frequency (3 times/week)

intensity (50% of VO_2 max)

time (10-45min)

type (endurance/strength)

↓

MET level, Borg scale, Karvonan's formula, or VO_2 max can be taken for designing protocol.

Eg: endurance (if 30min 5min warming 20 min ex, 5 min cool down)

strength (if 20 min, 5 min warmup 10 rep with 2 min rest time (10 min) 5 min cool down)

- optimal bronchodilator therapy should be given prior do exs training to enhance performance.

- pts who are receiving long term O_2 therapy should have their continued during exs training. but may need increased flow rates (high level O_2 3, 4, 5 lit)

→ Nutritional advices:

- high calorie rich diet is recommended
- energy dense fluids
- pt experiences less dyspnoea after carb rich supplement than fat rich
- high protein rich diet is encouraged

→ psychological support.

- screening for anxiety & depression should be a part of inital Rx
- mild or moderate levels of anxiety or depression related to disease causes may improve with PR

- pt with significant psychiatric device should be referred for appropriate professional care.

→ outcome assessment

- providing pt's with an opportunity to give feedback about the program is a useful measure of quality control

- patient's feedback also allows co-ordinator to evaluate the components of PR that pt finds more useful.

cardiac rehabilitation

→ definition

cardiac rehab is a multiphasic program of medical care that is designed to restore the coronary heart disease patient to full & productive life.

(or)

the term cardiac rehab refers to coordinated multifactorial interventions designed to optimize the cardiac patients physical, psychological & social functioning in addition to stabilising slowing or even reversing the progression of the underlying atherosclerotic process there by reducing morbidity & mortality.

→ risk factors:

- irreversible (or) fixed risk factors

1. age
2. male genders
3. family history of CAD
4. past history of CAD

reversible / modifiable risk factors

1. cigarette smoking
2. HTN
3. hyperlipidemia
4. obesity
5. sedentary life style
6. low high density lipoprotein cholestrol

→ team mem

1. cardiologist
2. Nurse
3. PT
4. psychologist
5. dietician
6. social worker
7. OT
8. pharmacist
9. exs physiologist

→ goals & objectives

short term

1. improving the functional capacity of the patient.

2. psychological support during recovery phase
3. education to the patient & family about the disease.
4. decreased cardiac morbidity & relief symptoms.

<u>long term goals</u>

1. identifying & treating the risk factors that influence the progression of disease.
2. teaching & reinforcing the health behaviour that improves prognosis
3. optimising physical conditioning & facilitating return to occupational & vocational activities.

→ <u>Indications</u>

1. MI
2. Angina pectoris
3. coronary artery bypass grafting (CABG)
4. valvotomies
5. valve impairment

6. percutaneous translaminal coronary angioplasty
7. Heart transplantation
8. stable chronic heart failure
9. peripheral artery disease.
10. patient with pacemakers
11. children with congenital cardiac disorder
12. diabetic patients.

→ contraindications :

1. Medically unstable past MI
2. unstable angina
3. resting systolic Bp more than 200 mmHg & diastolic Bp is more than 110mmHg.
4. orthostatic hypertension
5. ~~Acute~~ Acute systemic illness / fever
6. uncontrolled atrial or ventricular arrythmias
7. uncontrolled sinus tachycardia
8. embolism (recent).

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|exs tolerance testing|

Indications

- to estimate prognosis
- to estimate / determine functional capacity of the patient
- to determine effects of therapy
- screening of apparently healthy individuals

Intro -

ETT (or) stress testing is an essential first step in the exercise training phase of any cardiac rehab program.

- it is used to create an individualised exercise prescription allowing an optimal level of training stimulus ~~optimal~~ without exposing the patient to risk.
- to asses the ability of CVS to accomodate to ↑sing systemic O_2 demands an ETT is useful.

- the patient exercise through stages of ↑sing workloads expressed in units of O_2

- O_2 cause may be expressed in litres/min or ml/kg/min

<u>metabolic equivalent</u> (MET)

- it is defined as basic systemic O_2 requirement at rest.

- roughly it is about 3.5 ml O_2/kg/min = 1 MET

- the two major goals of ex testing is to detect the presence of ischemia & to determine the functional aerobic capacity of the individual.

- ETT can be done in treadmill, bicycle, argometer, upper extremity argometer etc

- if it is done on treadmill 'BRUCE PROTOCOL" is used

- Bruce protocol for young active subjects

stage	METs	speed (mph)	grades	duration
1	5	10	1.7	3
2	7	12	2.5	3
3	9.5	14	3.4	3
4	13	16	4.2	3
5	16	18	5 0	3

Contraindications

a. absolute

- acute MI
- unstable angina
- Serious cardiac dysarythimias
- acute pericarditis, myocarditis
- severe aortic stenosis
- severe ventricular dysfunction
- acute or serious non-cardiac disorder
- severe physically handicapped

b. relative

- any less serious non cardiac disorder
- significant arterial / pulmonary HTN
- moderate valvular or myocardial heart disease

→ **terminatim of testing**

- dizziness
- angina
- extreme pain / extreme fatigue
- hypotensive response / hypertensive response with systolic BP > 260mm Hg or diastolic pressure > 150 mm Hg.
- mechanical (or) techical problems with monitoring
- sustained ventricular tachycardia.
- subject desired to stop

→ **phases of cardiac rehabilitatim**

phases

phase I	phase II	phase III	phase IV
acute phase (on the hospital) 2 weeks.	convalesend (discharge - 3months) i.e, 2-6 weeks	extraining (6 - 12 wks)	Maintenance (life long)

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1. phase I

objectives

- to assess the patient to become ambulatory
- to prepare patient for graded ex program.
- to reduce psychological stress
- to identify & modify the CAD risk factors.
- educate patient & family.

exs program

step 1 (or) DAY 1

1. active ROM exs
2. active ROM of all extremities with proper breathing techniques in supine lying.
3. surgical pts sitting up on chair 2 times daily
4. Ambulation with assistance in room
5. MET level is 1 to 1.5

step II

- Repeat all exs
- surgical pts. All exs in 45° posn (prop up)
- short walk with assistance
- MET level is 1-1.5

step III

1. Repeat all previous exs with mild resistance
2. surgical pts - exs in sitting on bed
3. ↑ se walking
4. MET level is 1-2

step IV

1. exs with mild resistance in sitting with proper breathing, surgical pts
2. walk without assistance in room & longer walk in corridor with assistance
3. MET level is 1.5 - 2

step V

1. repeat step II exs with moderate resistance with proper breathing
2. walk to tolerance not more 50 feet
3. surgical patient - ex in standing with 1 to 2 pounds wt lateral side bends & continue walking.
4. MET level is 1.5 - 2

step vi

- AROM to all extremities with 1.2 lb wt while standing
- shoulder add. arm circular with scapular adduction
- walk to tolerance not more than 100 feet
- surgical pts walk without assistance
- MET level 1.5 to 2

step vii

- Repeat step vi exs
- walk to tolerance not more than 200 feet
- surgical pts - repeat step vi flight stairs with assistance & then up elevator
- MET level 1.5 to 2.5

step viii

- repeat step vii exs
- walk to tolerance not more than 300 feet
- surgical pts : repeat step viii exs continue walking walk down two flight stairs with assistance & up elevator
- MET level 1.5 to 2.5

step ix

- Repeat step viii exs
- add knee bends
- walk to tolerance
- surgical patients - walk down two flight stairs with assistance & up elevator
- MET level - 2 - 2.5

step x

- repeat step ix exs
- walk down 2 flights stairs with assistance & up elevator
- surgical patients - repeat step ix
- MET 2 - 2.5

step xi

- repeat step x exs
- walk down 1 flight & up with assistance
- MET level 2.5 to 3

instructions

- vitals should be monitered before

during, after exs

- duration - 10 to 15 min twice daily supervised
- progression - one or two steps / day &
  duration ↑sng to 20 - 30 min
- intensity - RPE (11 to 13)

<u>criteria</u> for terminating exs:

- fatigue
- ↑ in nervous system symptoms Eg: ataxia, dizziness
- signs of poor perfusion (cyanosis / pallor)
- onset of angina
- ex. hypotension (≥ 20mm Hg drop in systolic BP)
- systolic BP > 220 or diastolic BP > 110mmHg
- HR ↓sed > 10 beats / min with ↑se workload / nochange
- onset of 2nd / 3rd degree of AV block.

2. phase II or convalescent phase (or) discharge to 3m

- ex program is usually low intensity to prepare for a mod- high intensity program in the next phase of rehab.

frequency - 3-4 days/week (or) 1-2 times/day

intensity - mild - moderate - HR (40-60%) of max H.R

- RPE. 11-13 (light some what hard)
- above 5 METs

duration : 15-30 min (MI & CABG)

slow progression to 30-60 min

3. phase III ex training phase

- from 6-12 weeks
- this is an actual ex training program
- symptom ltd ex testing before ex prescription.
- An individualised ex prescription for aerobic & resistance training
- ex prescription should specify duration, intensity, frequency & time.

- it includes warmup, cooldown & flexibility exs (stretching)

exs prescription

principle :

FITT principle (frequency, intensity, time (duration), type) progression.

intensity :

- Karvonan's formula

$$THR = [(MHR - RHR) (40-80\%)] + RHR$$

- MET's

- RPE - 20 - very very hard
19
18
17 - very hard
16
15 - hard
14
13 - somewhat hard
12
11 - fairly light
10
9 - very light
8
7 - very very light

→ 20 - 15 - this range is too hard

14 & 12 - Ideal range.

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frequency

3-5 days / week.

duration : 15-60min of continuous or intermittent training.

Mode of training - continous
circuit
internal

type of training - the ex prescripn should include both aerobic & resistance training

(a) aerobic training :

- initially preferred mode of aerobic exs is walking, stair climbing, fast walking
- progression to jogging
- later other activities (arms & legs & ergometry)
- arm cycle ergometry, swimming, cycling, rowing & aerobic dance can be introduced
- aerobic training in inspite, ↑ circulatory capacity for ex.

(b) resistance training:

- strength traing is included in many cardiac rehab program to facilitate patient tolerance for non-aerobic physical test,
- resistance training is to ↑se peripheral muscle strength endurace & mass
- for resistance training:

frequency - 2-3 days/week

intensity. initially start c̄ one set of 10-15 rep (rates 1-3 sets of 8-15 reps)

RPE - 11-14

modality for L.E. - leg extension, abd. add
UE - biceps, curls, triceps ext

- stretching & flexibility exs can begin as early as 24 hrs after CABG or MI

Note

low level resistance training should not begin until 2-3 weeks after MI.

4. <u>phase IV</u> (or) maintainance phase

- Maintainance of endurance & strength minimal (or) unsuperised ex program.
- this is the most imp phase of all because if it is neglected the benefits of training phase are lost c̄ in a few weeks
- the actual ex included should reflect the selection of muscle strain in the preceding period & should fit with in the interest, lifestyle of indi. patient.
- ex atleast twice a week, preferably 3 times a week for atleast 30 min should be considered a min requirement

→ <u>benefits of cardiac rehab</u>

1. improve psychological status
2. improve left ventricular funcⁿ
3. ↑se ischaemic threshold

4. ↑se coronary collaterals

5. ↓se platelet aggregatn & ↑se fibrinosis

2. presentation

- BP control
- stoppage of tobacco use
- lipid control
- wt reductn
- regular social physical activity.
- ~~psychologe~~ psychosocial Rx
- education.

t

SUCTIONING

→ **Intro:**

- Airway suctioning is frequently required for patients in ICU in order to facilitate the removal of secretions
- this is the passive method of removal of secretions
- All incubated patient require suction whether receiving ventilatory assistance or not

→ **Indications**

- whenever suctions can be heard in an incubated patient
- for retained secretions in a spontaenously breathing patient who is unable to cough & expectorate efficiently

(or)

- if the min volume drops this may indicate retained secretions.

- if the inflation pressure of the ventilator suddenly uses this may indicate presence of large plug of mucus in one of the large bronchi or even in the endotracheal or tracheostomy tube.

→ <u>suction</u> <u>equipment</u>

- various types of suction apparatus are available to produce suction force necessary to aspirate substances

<u>types</u>

1. <u>suction</u> apparatus - designed to work from a vaccum point close to patient bed. this is the type of apparatus most commonly found in ICU's. there is an on-off switch, control dial which allows the applied -ve pressure to be ↑sed or ↓sed a manometer displays the pressure used.

2. <u>electrical suction apparatus</u> - is powered from the mains

- this type has a small motor, on-off switch, control dial

- this is the equipment most commonly used in wards where a vaccum point is not available.

3. <u>portable suction apparatus</u> - is powered by recharagable batteries

- this too has a small motor & a on & off switch

4. <u>foot pump</u> - here the power is provided by the operator

5. <u>suction tubing</u> - this leads from the suction bottle to the connection for suction catheter

- usually the tubing is made from clear plastic for easy viewing of secretions

- sometimes rubber tubing is also used.

6. <u>connections</u> - these are usually plastic & either clear or semitransparent

- most connections have 3 holes or in the case of Y connected 3 arms

7. catheters - Many suction catheters are available

- Most are made from clear plastic & disposable
- commonly used catheter size for adult patient are 10, 12, 14, 16 (french gauge) & are usually color coded for size
- it is vital that correct size of catheter is used for each patient.
- soft rubber catheter are used these are not disposable & must be sterilized after use
- there are particularly useful for naso pharyngeal suction as they causes less trauma, because they are softer & more flexible than plastic catheter
- all catheters should be used once only & then thrown away if disposable, if rubber collected for sterilisation

8. suction trolley - all the equipments needed for airway suction should be sent out on a trolley for easy way of access

- sterile plastic gloves those are disposable
- suction catheters of appropriate size
- lubricant jelly (water based used in nasopharyngeal suctioning)
- bowl of $NaHCO_3$ or sterile water to flush the secretion through the catheter
- plastic bag for collection of disposable
- bowel of antiseptic solution for collection of items to be sterilized.

* suction technique

- sterile suction technique must always be carried out to avoid infectious entering into the respiratory tract.
- it should be done by using sterile plastic gloves for introducing the catheters

- before use the equipment should be checked for efficient suction appropriate pressure selected b/w -100 to -120mm Hg
- this is ideal for most patients
- pressure upto -200mmHg may be needed for thick secretions.

Mode of entry

a suction catheter may be introduced into the respiratory tract via the nose, mouth or tube

1. Nasopharyngeal suction

- When introducing suction catheter through the nose it is helpful the patient neck is extended so that head is tilted backwards resting on a pillow
- if the patient co-operate tongue should be protruded
- this helps to pass the catheter b/w the vocal cords into the trachea

- the lubricated catheter is held b/w finger & thumb of gloved hand & introduced into the nose
- it is directed slightly backward & upward until the tip reaches posterior naris where a little resistance may be felt.
- gentle rolling of catheter at this point allows the advancement of catheter into the pharynx.
- the aim is to stimulate cough reflex & advancement of catheter on insp only with mouth open.
- nasopharyngeal suction is a very unpleasant experience for the concious patient should only be used when absolutely necessary.
- Nasopharyngeal suction should not be used for patients with head injury where there is a leak of CSF into the nasal passages

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2. oesopharyngeal suction

- in this the catheter is introduced thus mouth
- A lubricated plastic airway is usually needed to present the patient billing the catheter

3. suction via tube / endotracheal

- in this the catheter is inserted or introduced into the endotracheal or tracheostomy tube.
- it should be remembered that if the patient is dependent on ventilator the time available for suction is limited.

suction

- Whatever the mode of entry physiotherapist should not apply suction pressure when catheter is being introduced.
- the catheter should be advanced until either a cough reflex is elicited or

resistance in the trachea is met.

- suction is then applied by occluding the open hole of the control pole

- then the catheter is slowly withdrawn while gentle rolling of catheter b/w finger & thumb

- vigorous up & down movement of the catheter should be avoided.

- at all the times during the procedure it should be imp to absent the signs of hypoxia & if this occurs administer O_2 or ventilator immediately.

- after suctioning the patient must be reconnected immediately to the O_2 supply

- the pt should flush the catheter through with sodium bicarbonate or sterile water

- the suction pump should be switched off

→ complications / Hazards of airway suctn / adverse effects

- hypoxia
- cardiac arythmia
- trauma.
- atelectasis